

JUN 25 1973

APOLLO SOYUZ TEST PROJECT (ASTP)

DIRECTIVE NO. 6 *

TO: Distribution

FROM: Chester M. Lee
Program Director, ASTP

SUBJECT: Key Inspection, Review and Certification Checkpoints and Their Documentation

OFFICE OF PRIME RESPONSIBILITY (OPR): ASTP Engineering (MAE)

- REFERENCES:
- (a) NHB 8040.2, Apollo Configuration Management Manual
 - (b) NHB 8080.1A, Apollo Test Requirements
 - (c) NHB 5300 Series, Reliability and Quality Program Provisions
 - (d) NHB 5300.4(1A), Reliability Program Provisions for Aeronautical and Space System Contractors
 - (e) NHB 5300.4(1B), Quality Program Provisions for Aeronautical and Space System Contractors
 - (f) ASTP Dir. No. 8, Apollo Soyuz Flight Readiness Review

I. PURPOSE

The purpose of this directive is to identify, list and briefly describe the key inspections, reviews and certifications which are required as control checkpoints for the Apollo Soyuz Test Project. These key checkpoints are oriented to the hardware and software development and mission phases of the project to assure the adequacy of system design, manufacture and testing prior to mission accomplishment.

II. SCOPE

This directive covers the requirements, responsibilities, conduct and resultant reporting of the following key checkpoints.

- A. PDR - Preliminary Design Review
- B. CDR - Critical Design Review
- C. FACI - First Article Configuration Inspection
- D. CARR - Customer Acceptance Readiness Review
- E. COFW - Certification of Flight Worthiness

* Vertical Bars in right margin indicate changes from APD No. 6B dated 12/2/68

- F. DCR - Design Certification Review
- G. JFRR - Joint Flight Readiness Review (USA/NASA - USSR/NAS)
- H. Pre-FRR - Pre Flight Readiness Review
- I. FRR - Flight Readiness Review (ASTP Dir. No. 8 for full coverage)
- J. L-2 - Pre Lift-Off Readiness Review

Details on most of these checkpoints (except DCR, JFRR, Pre-FRR, and L-2) have been developed in the reference documents. Resulting Center implementation should reflect this total picture.

Under terms of this directive either or both a CARR and FACI may be held with the understanding that the objectives of FACI, as defined in NHB 8040.2 (Ref. a), are accomplished by a CARR (Section V).

III. APPLICABILITY

The PDR, CDR, FACI, CARR, COFW, DCR and JFRR are conducted at the Contract End Item (CEI) or equivalent module level. The center Pre-FRR's, the FRR, and the L-2 encompass the total system. The review progression and schedule is shown in Figure 1 along with review responsibilities.

The Apollo Test Requirements, NHB 8080.1A (Ref. b) and NHB 5300 Series documents (Ref. c) contain general requirements for test, reliability and quality assurance. To the extent these requirements affect or pertain to Contract End Items, they should be reflected in the appropriate sections of the Contract End Item Specifications (Parts I & II) prepared to satisfy the requirements of NHB 8040.2 (Ref. a). The specifications will then contain all the technical requirements imposed by Hqs. documents and will serve, along with the drawing structure, as the primary documents against which reviews, inspections and certificates will be accomplished.

It is recognized that it may be desirable from the Program Director's or Program Managers' viewpoint to conduct additional reviews, inspections and certifications to validate the compatibility of the specifications, drawings, hardware and test results. Summaries of each of the key inspections, reviews and certifications are contained in Section V.

- IV. Definition of terms can be found in Exhibit XVII of NHB 8040.2. (Ref. a)

V. REVIEW PROCEDURES

A. Preliminary Design Review (PDR) and Critical Design Review (CDR)

The PDR is a technical review of the basic design approach and is conducted prior to, or early in, the detail design phase. The CDR is a technical review of specifications and drawings conducted, ideally, prior to release of drawings for manufacture. For further details refer to Exhibit XIV of NHB 8040.2 (Ref. a).

1. PDR - Preliminary Design Review

The purpose of a PDR is to formally review the design approach of a Contract End Item prior to, or very early in, the detail design phase.

The PDR establishes:

- a. The compatibility of the selected design approach for the Contract End Item with the Contract End Item Spec. Part I.
- b. The system compatibility of the design approach by reference to predesign drawings, schematic diagrams, layout and envelope drawings, etc.
- c. The integrity of the design approach by review of analyses, breadboard models, mockups, circuit logic diagrams, packaging techniques, etc.
- d. The identification of the portions of the selected design approach to be subjected to detailed value engineering analysis.
- e. The producibility of the selected design approach by review of requirements for special tools and facilities.

The detail requirements are covered in NHB 8040.2 (Ref. a). |

2. CDR - Critical Design Review

The purpose of a CDR is to formally review the design of a Contract End Item when the design is essentially complete and is intended to precede the release of engineering for manufacture. The CDR establishes:

- a. The compatibility of the Contract End Item as designed with the Contract End Item Spec. Part I.
- b. The system compatibility of the completed design by reference to ICD's, schematics and functional block diagrams.
- c. The integrity of the design by review of analytical and test data, and reliability apportionment and analysis available at that particular point in time.

The detail requirements are covered in NHB 8040.2 (Ref. a). |

B. First Article Configuration Inspection (FACI) and Customer Acceptance Readiness Review (CARR)

1. FACI - First Article Configuration Inspection

The FACI examines a selected (earliest possible) manufactured end item (hardware and software) against the specification requirements, and released engineering drawings, and validates the acceptance testing. It may be necessary to reconduct the inspection, e.g., Δ FACI, one or more times to insure that the contractor has corrected deficiencies identified at the first inspection. These inspections will result in the establishment of a firm baseline of specifications and drawings.

Additionally, a FACI should be conducted on each major configuration departure from the basic hardware definition. Subsequent to FACI all end items will be accepted on a DD-250 (or equivalent) subject to all the requirements of acceptance contained in the specification and NHB 8040.2 (Ref. a).

The purpose of the FACI is to establish the Product Configuration Baseline for the Contract End Item. It is accomplished by establishing the exact relationship of the Contract End Item as described by released engineering to the Contract End Item as manufactured and assembled. The products of a FACI include:

- a. Acceptance of Part II of the Contract End Item Specification
- b. Validation of acceptance testing
- c. Comparison of the configuration of the end item unit undergoing First Article Configuration Inspection with the end item unit qualified or undergoing qualification if they are not the same unit.
- d. Documented DD-250 (or equivalent) indicating shortages and deficiencies which must be resolved prior to the FRR.

The detail requirements are covered in NHB 8040.2 (Ref. a).

2. CARR - Customer Acceptance Readiness Review for JSC End Items.

The purpose of CARR is validation of the configuration of each end item accepted for delivery. The CARR examines each spacecraft end item (hardware and software) against the specification requirements, and released engineering drawings, evaluates the system performance as obtained during checkout operations, and validates the acceptance testing. A CARR may be used in lieu of FACI if FACI requirements are satisfied. In addition, verification is made during CARR that all mission constraints are valid and the CEI is capable of the stated performance and is ready

for delivery. After a complete review of the Acceptance Data Package (ADP) and completion of CARR, the first endorsement of the Certification of Flight Worthiness (COFW) and/or the DD-250 are signed.

When CARR is used in lieu of FACI it may be conducted in as many phases as required but the final phase should always be just prior to delivery. The products of a CARR include:

- a. Acceptance of Part II of the Contract End Item Specification.
- b. Assessment Review following subsystem tests.
- c. Documented DD-250 indicating shortages and deficiencies which must be resolved prior to the FRR.

C. COFW - Certification of Flight Worthiness

The purpose of the COFW checkpoint is to certify that each flight stage and module is a complete and qualified item of hardware prior to shipment and is accompanied by adequate supporting documentation. This also certifies adequacy of appropriate software at this point in time. The COFW procedure informs the ASTP Program Director of any deficiencies prior to shipment from the manufacturing site and from the static firing site.

The COFW certifies that:

1. Acceptance tests through manufacturing checkout, qualification tests, and reliability demonstration tests have been successfully completed and meet the requirements of Sections 3.6, 3.7, and 3.8 of NHB 8080.1A (Ref. b). Failures of flight hardware in criticality categories 1 and 2A (defined in Table 3-1 of NHB 8080.1A (Ref. b)) have been analyzed and corrective action implemented in accordance with NHB 5300.4(1A) (Ref. d).
2. The spacecraft, docking module, docking system, experiments, vehicle, system, subsystem, assembly and component specifications and drawings were developed in accordance with the NHB 5300.4(1A) (Ref. d), and NHB 5300.3(1B) (Ref. e). Each departure therefrom has been approved by the Material Review Board in accordance with paragraph 1B804 of NHB 5300.4(1B) (Ref. e).
3. The hardware has been manufactured, inspected, and tested in accordance with the approved quality control program as specified in Chapter 7 of NHB 5300.4(1B) (Ref. e).
4. The item of hardware is complete and in accordance with paragraph 1B704 of NHB 5300.4(1B) (Ref. e).

5. All data packages and support manuals necessary for operation and checkout of the item are complete, compatible, and accompany the hardware, and that shipping requirements of paragraph 1B1102 NHB 5300.4(1B) (Ref e) have been met.

The detail requirements are covered in NHB 8080.1A (Ref. b).

NOTE: FACL, CARR and DD-250 data requirements applicable to the COFW shall be used for the COFW.

D. DCR - Design Certification Review

The DCR will be scheduled by a letter signed by the Associate Administrator for Manned Space Flight.

The purpose of the DCR checkpoint is to certify the design of selected new and modified elements of the total space vehicle system, docking module, docking system, experiments, and mission flight complex for flight worthiness and manned flight safety by a thorough formal review of the development and qualification of all pertinent stages and modules and their installed subsystems. Data to be reviewed at the DCR shall include the following:

1. Design Description

- a. Mission Requirements/Design Requirements
- b. Mission Capability
- c. Mission Constraints
- d. Design Configuration and Interface Compatibility
- e. Design Safety Evaluation
- f. Configuration Deltas Over Flight Tested Hardware

2. Design Verification

- a. Design Requirements/Test Requirements
- b. Test Programs
 - (1) Identification of Test Program
 - (2) Test Program Conditions and Control Disciplines
 - (3) Test Results in Summary
- c. Flight Verification
- d. Failure History of Items Experiencing Repeated Failures
- e. Corrective Action on DCR and FRR Open Action Items and Open Mission Anomalies

3. Critical Technical Areas of Concern

4. MSF Operations Support

5. MSF Program Managers Assessment

6. Operational Safety Review

NOTE: FACL, CARR, COFW and DD-250 data requirements applicable to the DCR shall be used for the DCR.

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E. JFRR - Joint Flight Readiness Review (USA/NASA - USSR/NAS)

The JFRR will be scheduled by the Technical Project Directors at approximately the time shown in Figure 1. Its purpose will be to assure the flight readiness of all interfacing elements of the project. The Technical Project Directors will determine the scope of this review, chair it and approve any actions necessary to assure flight readiness.

F. Pre-FRRs - Pre-Flight Readiness Reviews

The Pre-FRRs at the Centers (JSC, MSFC & KSC) will be scheduled by the Program Managers at approximately the time shown in Figure 1. Their purpose will be to assure the flight readiness of all elements of the project. The Program Managers will determine the scope of the reviews, chair them and approve any actions necessary to assure flight readiness.

The Director, ASTP Engineering, will attend each Pre-FRR acting for the ASTP Program Director, and will accept items he determines to be completed and not requiring the Program Director's Review. Such items will not appear on the final FRR agenda except for problems which may occur between the Pre-FRR and the FRR. Buy-off will be accomplished by a meeting subsequent to the Pre-FRR or by a TWX within two working days following the Pre-FRR.

G. FRR - Flight Readiness Review

The FRR will be scheduled by a letter signed by the Program Director.

The purpose of the FRR checkpoint is to determine that the space vehicle hardware, docking module, docking system, experiments, software, and launch complex are ready to commence the mission period. It includes certification that the JFRR was satisfactorily completed and review of any JFRR open items. It involves the readiness assessment of the:

1. Launch Vehicle
2. Launch Complex
3. Spacecraft, Docking Module, Docking System, and Experiments
4. Manned Space Flight Network
5. Flight Control
6. Flight Crews
7. Recovery Planning
8. Medical Planning
9. Public Information Planning

The following items should be considered in the review at this time:

1. The checkout and qualification test status of all hardware and software.

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2. The summary of failures and the disposition of the failures, with particular emphasis on failures that have occurred during the pre-launch and checkout phase where records indicate a previous failure history.
3. All modifications, deviations and waivers. A certification that the space vehicle hardware and software end items are described by officially released engineering and that all required engineering changes after hardware and software delivery from the factory or contractor have been installed.

The review compares the status of major operational elements of the mission with requirements outlined in the Mission Implementation Plan and the Program Support Requirements Document which are developed in accordance with the Program Plan.

The detail requirements are covered in ASTP Directive No. 8 (Ref. f).

NOTE: FACI, CARR, COFW, DCR, and JFRR data requirements applicable to the FRR shall be used for the FRR.

H. Pre Lift-Off Readiness (L-2 Day) Review

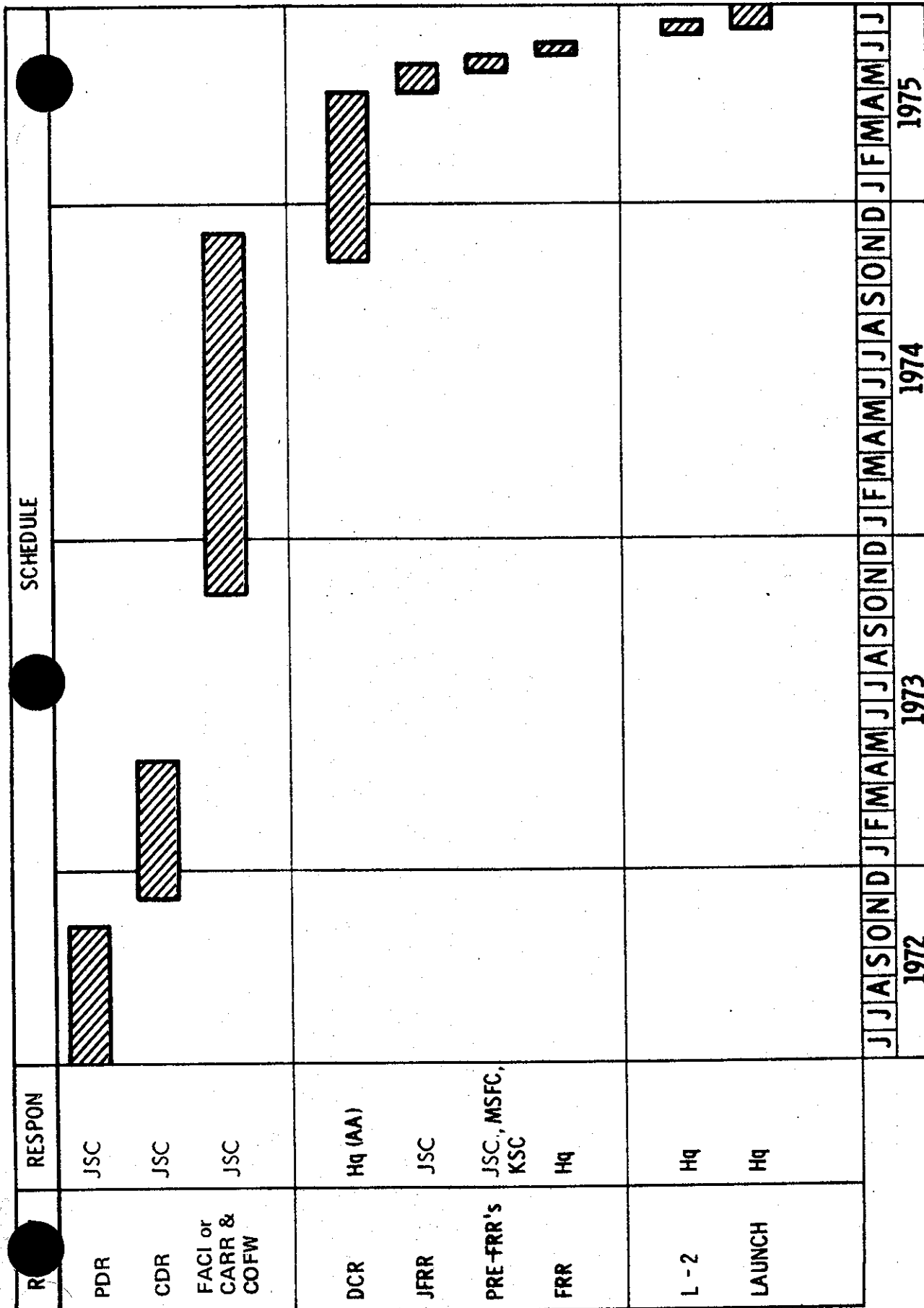
The Pre Lift-Off Readiness (L-2 Day) Review will be scheduled by the Program Director and will normally occur two days prior to launch. The purpose of the review will be to determine Mission Readiness. At this review, Center Program Managers will close out (1) action and open work items identified during and subsequent to the FRR, (2) failures and anomalies from preceding OMSF missions which could have an impact on the Apollo Soyuz mission, and (3) pertinent action items from the Design Certification Review. Certificates of Flight Worthiness will be executed and submitted to the Program Director.

VI. RESPONSIBILITIES

The conduct of the PDR, CDR, FACI, CARR, COFW, JFRR, and Pre-FRR is the responsibility of the Center having development responsibility for the end item. The conduct of the DCR is the responsibility of the Associate Administrator for Manned Space Flight. The conduct of the FRR and the Pre Lift-Off Readiness Review is the responsibility of the ASTP Program Director.

VII. CANCELLATION

This Directive supercedes Apollo Program Directive No. 6B issued December 2, 1968.



ASTP REVIEWS (Approximate Dates)

Figure 1



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
JOHN F. KENNEDY SPACE CENTER
KENNEDY SPACE CENTER, FLORIDA 32899

JUL 30 1973

REPLY TO
ATTN OF: AA-GSO-2

MEMORANDUM

TO: Distribution

FROM: AA/Acting Manager, Apollo-Skylab Programs

SUBJECT: ASTP Directive No. 6

Attached is a copy of ASTP Directive No. 6, "Key Inspection, Review, and Certification Checkpoints and their Documentation", and a copy of my Briefing Note to Dr. Debus. Our present reviews are delta reviews from the previous mission, and the ASTP reviews are expected to be delta reviews from SL-4, using the S-208 and CSM-118 vehicles as a baseline. One new review, the Joint Flight Readiness Review, has been added. This is a review of flight vehicle interface equipment and systems.

William H. Rock
William H. Rock

Attachment: a/s

Distribution:
Skylab-ASTP Distribution M

Dr. Debus

JUL 23 1973

SUBJECT: ASTP Program Directive No. 6

We have received and reviewed ASTP Program Directive No. 6 (ASTPD #6), "Key Inspection, Review, and Certification Checkpoints and their Documentation", a copy of which is attached. The requirements of ASTPD #6, with one exception, are the same as those of Apollo Program Directive 6B (APD #6B), "Key Inspection, Review, and Certification Checkpoints and their Documentation", and Skylab Program Directive 11A (SLPD #11A), "Sequence and Flow of Hardware Development Key Inspection, Review and Checkpoints".

The new Directive, ASTPD #6, causes no impact except a minor revision of certain supporting KSC documents to reflect their applicability to the ASTP mission.

One new review, the Joint Flight Readiness Review (JFRR) has been added. This review is conducted to determine the readiness of all interfacing flight hardware and software systems to support the mission. It will occur in the same general time frame as the Pre-flight Readiness Reviews. The Technical Project Directors of USA/NASA and USSR/AS will determine the scope of and chair the review and will assign action items as necessary.

Copies of this ASTP Directive will be forwarded to the appropriate Directorates and Offices under separate cover.

William H. Rock
William H. Rock